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Attorney's Docket No. 0756-945

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

Hisato SHINOHARA et al

Application No.: 08/169,127

Filed: December 20, 1993

For: METHOD AND SYSTEM OF
LASER PROCESSING

)

) Group Art Unit: 1112

) Examiner: Padgett

) CERTIFICATE OF MAILING

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BRIEF FOR APPELLANT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This appeal is from the decision of the Primary Examiner dated June 6, 1995 (Paper No. 13), finally rejecting claims 1-16 of which claims 1-4, 6-9, 11-14 and 16 are the subject of the present Appeal and reproduced as an Appendix to this brief. Cancellation of claims 5, 10 and 15 was requested in a Third Amendment After Final filed concurrently herewith.

A check covering the \$290.00 requisite Government fee and two extra copies of this brief are being filed herewith.

The Commissioner is authorized to charge any fees that may be required by this paper, and to credit any overpayment, to Deposit Account No. 19-2380.

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I. Real Party in Interest

The Real Party in Interest of the subject application is Semiconductor Energy Laboratory Co., Ltd. as noted in the assignment recorded March 14, 1994 at reel 6893, frame 0673.

II. Related Appeals and Interferences

Appellant, Appellant's representative and the assignee are unaware of any other appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board of Appeals decision in the pending appeal.

III. Status of Claims

Claims 1-4, 6-9, 11-14 and 16 are presently pending in the instant application. No claims have been indicated as being allowable by the Examiner. Appellant has requested cancellation of claims 5, 10 and 15 in a Third Amendment After Final filed concurrently herewith.

IV. Status of Amendments

All amendments made during prosecution prior to final rejection have been entered. A first Amendment After Final made following final rejection to clarify claims 1, 6 and 11 was entered upon filing of this appeal. A Second Amendment After Final was denied entry. The claims involved in this appeal as attached in the appendix include all submitted amendments except those submitted in the Second Amendment After Final. A Third Amendment After Final, filed concurrently herewith, requests cancellation of claims 5, 10 and 15.

V. Summary of the Invention

The present invention, as shown in FIG. 1, relates to a method for treating an object with a laser for the purpose of controlling the shape of a laser beam so as to form a line-shaped pattern on the object (See page 6, line 4 - page 8, line 13). The method includes the steps of emitting a laser beam from a laser and expanding the beam in a first direction (FIG. 2B). The expanded beam is then passed through a mask for removing a peripheral portion of the beam wherein the peripheral portion includes edges of the expanded beam (FIG. 2C). The masked beam is then condensed in a second direction orthogonal to the first direction (FIG. 2D) to form a condensed laser beam having a line-shaped transverse cross-section at the object (claim 1). The laser beam emitted from the laser may be rectangular in shape (claim 6). The present method may include the step of changing the relative location of the object with respect to the line-shaped laser beam so that the object is scanned with the beam (claim 11). The expander provides the necessary width to the beam while the removal of a peripheral portion of the expanded beam reduces the undesirable aberration effect of the subsequent condensing step. As a result, the present method steps, and sequence thereof, provide a condensed laser beam having an optimum line-shaped transverse cross-section at the object.

VI. The Issues

A. Whether Appellant's claims 1-4, 6-9, 11-14 and 16 as amended by the first Amendment After Final are supported by Japanese priority application 61-229252.

B. Whether claims 1-4, 6-9, 11-14 and 16 are obvious in view of U.S. Patent No. 4,786,358 issued to Yamazaki et al. alone or in combination with U.S. Patent No. 4,680,855 or U.S. Patent No. 4,713,518 and Japanese Patent No. 403024259 to Toshiba KK or European Patent Application No. 209131 to NEC Corp.

or U.S. Patent No. 4,915,981 issued to Traskos et al. or U.S. Patent No. 4,444,801 issued to Hongo et al. or U.S. Patent No. 4,784,963 issued to Krimmel et al.

VII. Grouping of Claims

The claims stand or fall together. This statement is made only for the purposes of the appealed issues and is not an admission that the claims are not patentably distinct for other reasons.

VIII. Argument

A. Appellant's claims 1-4, 6-9, 11-14 and 16 as amended by the first Amendment After Final are supported by Japanese priority application 61-229252.

Appellants have established a chain of pendency back to U.S. application Serial No. 097,190 filed September 16, 1987 which claims priority to Japanese application 61-229252 filed September 26, 1986, prior to the August 7, 1987 U.S. filing date of U.S. Patent No. 4,786,358 to Yamazaki et al. Accordingly, as discussed in paragraph B hereinbelow, U.S. Patent No. 4,786,358 to Yamazaki et al. should be removed as prior art to claims 1-4, 6-9, 11-14 and 16.

All subject matter recited in claims 1-4, 6-9, 11-14 and 16 is disclosed in Japanese priority application 61-229252. With respect to independent claims 1, 6 and 11, the certified English translation of Japanese priority application 61-229252, previously submitted to the examiner, clearly describes on page 3, line 18 - page 4, line 23 the claimed steps of the method of present invention as recited in independent claims 1, 6 and 11, including emitting a laser beam, expanding the beam in a first direction, removing a peripheral portion of the expanded beam through a slit which functions as the claimed mask wherein the peripheral portion includes edges of the expanded beam, and condensing the masked beam in a second direction orthogonal to the first direction. The condensed laser beam has a line-shaped transverse cross-

section at the object as stated on page 3, line 22 and shown in Fig. 2. Moreover, Fig. 1 shows the various components including a laser, expander, mask and condenser arranged to achieve the method steps of claims 1, 6 and 11. Page 4, lines 3-24 and page 5, lines 20-24 specifically recognize the advantages of the sequence of method steps. With respect to claim 6, page 6, lines 2-4 disclose emitting a rectangular laser beam having a dimension of 16mm x 20mm. With respect to claim 11, page 7, line 18 - page 8, line 5 discloses changing the relative location of the object with respect to the beam by moving a table on which the object is mounted.

As to dependent claims 2, 7 and 12, page 6, lines 11-13 disclose the use of a synthetic quartz lens to condense the laser beam.

As to dependent claims 3, 8 and 13, page 3, lines 18-20 disclose the use of a pulse laser for treating an object.

As to dependent claims 4, 9 and 14, page 4, lines 3-5 disclose the use of an excimer laser for treating an object.

As to dependent claim 16, page 8, lines 1-5 in combination with Fig. 3 recognizes scanning the object to be treated in a direction orthogonal to the direction of expansion of the beam by the expander.

B. Whether claims 1-4, 6-9, 11-14 and 16 are obvious in view of U.S. Patent No. 4,786,358 issued to Yamazaki et al. alone or in combination with U.S. Patent No. 4,680,855 or U.S. Patent No. 4,713,518 and Japanese Patent No. 403024259 to Toshiba KK or European Patent Application No. 209131 to NEC Corp. or U.S. Patent No. 4,915,981 issued to Traskos et al. or U.S. Patent No. 4,444,801 issued to Hongo et al. or U.S. Patent No. 4,784,963 issued to Krimmel et al.

Appellants have established a chain of pendency back to U.S. application Serial No. 097,190 filed September 16, 1987 which claims priority to Japanese application

61-229252 filed September 26, 1986, prior to the August 7, 1987 U.S. filing date of U.S. Patent No. 4,786,358 to Yamazaki et al. Also, as shown hereinabove, all subject matter recited in claims 1-4, 6-9, 11-14 and 16 is disclosed in Japanese priority application 61-229252.

Thus, it is respectfully requested that U.S. Patent No. 4,786,358 has been removed as a prior art reference with respect to claims 1-4, 6-9, 11-14 and 16 of the present application. With U.S. Patent No. 4,786,358 removed as prior art for pending claims 1-4, 6-9, 11-14 and 16, it is respectfully requested that the rejections to claims 1-4, 6-9 and 11-14 and 16 under 35 U.S.C. §103 are rendered moot and, therefore, have been overcome.

With U.S. Patent No. 4,786,358 removed as prior art, Appellants also assert that claims 1-4, 6-9, 11-14 and 16 are allowable over the remaining prior art cited in the present rejection. Initially, it is respectfully submitted that Japanese Patent No. 403024259 to Toshiba KK having an effective prior art date of February 1, 1991; European Patent Application No. 209131 to NEC Corp. having an effective prior art date of January 21, 1987; and U.S. Patent No. 4,915,981 to Traskos et al. having an effective prior art date of August 12, 1988 are also removed as prior art by the September 26, 1986 priority date of the present application.

No prior art reference cited in the present rejection discloses or suggests masking a laser beam after expanding the beam. The Yamazaki et al. '855 and '518 references only suggest expanding the beam prior to condensing and no where suggest masking the beam. Although U.S. Patent Nos. 4,784,962 to Krimmel et al. and 4,444,801 to Hongo et al. disclose masking a beam prior to condensing the beam, these references no where suggest performing masking after any type of beam expansion. Also, the devices disclosed in Krimmel et al. and Hongo et al. are not used for the same purpose as Appellant's invention, i.e. to form line-shaped grooves in a surface, and, therefore, do not form a laser beam having a line-shaped transverse

cross-section at an object. Krimmel et al. masks a laser beam to form a planar exposure or image on a substrate (Col. 5, lines 1-4). Hongo et al. masks the beam for the purpose of shaping the beam to match the size of a transparent defect portion on a photomask (Col. 4, lines 58-62). Appellant's present invention masks the laser beam to reduce an undesirable spherical aberration effect on the beam caused by the condenser thus permitting very narrow line-shaped grooves to be formed on the object (Page 7, lines 2-4). Although the devices disclosed in the Yamazaki et al. '855 and '518 references generally form a beam having a line-shaped transverse cross-section at an object, the spherical aberration of the condenser results in a beam having a low intensity, and thus unclear, peripheral region. This low intensity, unclear region disadvantageously prevents the creation of a condensed laser beam having an optimum line-shaped transverse cross-section at the object and, thus, impedes the formation of narrow well-defined, line-shaped grooves. Appellant recognized and then solved this problem by positioning a mask prior to the condenser to remove a peripheral portion of the expanded beam. Neither Krimmel et al. nor Hongo et al. recognize the spherical aberration problem solved by Appellant's present invention. Consequently, Krimmel et al. and Hongo et al. do not suggest using a mask for forming beams having an improved line-shaped transverse cross-section at the object. Therefore, Appellants respectfully submit that no prior art cited in the present rejection, alone or in any combination thereof, anticipates or renders obvious Appellant's present invention as recited in independent claims 1, 11 and 16.

IX. Conclusion

For the reasons set forth hereinabove, it is respectfully submitted that Appellant's claims 1-4, 6-9, 11-14 and 16 as amended by the first Amendment After Final are supported by Japanese priority application 61-229252 and that claims 1-4, 6-9, 11-14 and 16 are allowable over the prior art of record. Accordingly, it is

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respectfully requested that the Examiner's rejection of claims 1-4, 6-9, 11-14 and 16
be reconsidered and reversed.

Respectfully submitted,

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APPENDIX

The Appealed Claims

1. A method for treating an object with a laser comprising the steps of:
 - emitting a laser beam from the laser;
 - expanding said laser beam in a first direction to form an expanded laser beam;
 - removing a peripheral portion of said expanded laser beam through a mask to form a masked laser beam, said peripheral portion including at least edges of said expanded laser beam extending in said first direction; and
 - condensing said masked laser beam in a second direction orthogonal to said first direction after removing said peripheral portion to form a condensed laser beam, said condensed laser beam having a line-shaped transverse cross-section at the object.
2. The method of claim 1 wherein the step of condensing said laser beam is done through a synthetic quartz lens.
3. The method of claim 1 wherein said laser is a pulse laser.
4. The method of claim 1 wherein said laser is an excimer laser.
6. A method for treating an object with a laser comprising the steps of:

emitting a rectangular-shaped laser beam from the laser;
expanding said laser beam in a first direction to form an expanded laser beam;

removing a peripheral portion of said expanded laser beam through a mask to form a masked laser beam, said peripheral portion including at least edges of said expanded laser beam extending in said first direction; and

condensing said masked laser beam in a second direction orthogonal to said first direction after removing said peripheral portion to form a condensed laser beam, said condensed laser beam having a line-shaped transverse cross-section at the object.

7. The method of claim 6 wherein the step of condensing said laser beam is done through a synthetic quartz lens.

8. The method of claim 6 wherein said laser is a pulse laser.

9. The method of claim 6 wherein said laser is an excimer laser.

11. A method for treating an object with a laser comprising the steps of:
emitting a laser beam from the laser;
expanding said laser beam in a first direction to form an expanded laser beam;

removing a peripheral portion of said expanded laser beam through a mask to form a masked laser beam, said peripheral portion including at least edges of said expanded laser beam extending in said first direction;

condensing said masked laser beam in a second direction orthogonal to said first direction to form a condensed laser beam, said condensed laser beam having a line-shaped transverse cross-section at the object; and

changing the relative location of said object with respect to said laser beam so that said object is scanned with said laser beam.

12. The method of claim 11 wherein the step of condensing said laser beam is done through a synthetic quarts lens.

13. The method of claim 11 wherein said laser is a pulse laser.

14. The method of claim 11 wherein said laser is an excimer laser.

16. The method of claim 11 wherein said object is scanned with said line-shaped laser beam in said second direction orthogonal to the first direction in which said laser beam is expanded.